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ABSTRACT

Reported is the development of a mathematics course for college freshmen of lower mathematics capabilities. Materials were geared toward multi-media presentation--classroom teacher in conjunction with video-lessons. A pilot study involved a group using new materials plus teacher with video-lessons, and a second group using new materials plus teacher without video-lessons. Data were obtained from staff and students via questionnaires and exposition of opinions. Findings indicate: students like the materials, study with more or the same interest as previously, tend to improve gradewise, and tend to like studying by T.V. less than by traditional means. Suggestions for future extensions of the reported study are discussed. (JG)

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Research Report

THE DEVELOPMENT OF CONTEMPORARY MATHEMATICS BY CLOSED CIRCUIT TELEVISION

Eino E. Maki
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Menomonie, Wisconsin

Cooperative Research

Wisconsin State Universities
and the
United States Office of Education
Bureau of Research · Higher Education

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Final Report

WSU-CORD
The Consortium of Research Development
Of The
Wisconsin State Universities

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Wisconsin State University - Stout
Menomonie, Wisconsin

July, 1969

U.S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE

Office of Education
Bureau of Research

Final Report

WSU-CORD
The Consortium of Research Development
Of The
Wisconsin State Universities

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Wisconsin State University
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CHAPTER I

INTRODUCTION

Statement of the Problem

The purpose was to develop a mathematics course utilizing closed circuit television, and to develop new course content with mathematical rigor and structure as guidelines. The materials are geared toward multi-media presentation, that is, classroom teacher in conjunction with closed circuit television.

During recent years, the mathematics department at Stout State University has experimented with three different textbooks, in order to find suitable material for our students. To date, we have found the textbook material unsatisfactory; either the material was too accelerated or too manipulative. Mr. Gauthier and Mr. Maki have conducted research on the 1964-65 and 1965-66 non-returnees at Stout State University. Since this study was in regard to a course required of most freshman boys, we wish to focus your attention to 421 non-returnee freshman boy's records in this time interval. 298 out of 421 of these students enrolled for credit in M-100 or M-209 or M-213. 149 out of 298 received one F (50%). 242 out of 298 received an F and if not an F then a D (81%). We believe that these statistics indicate that the mathematics grade received by a non-returnee is a contributive factor in making him a dropout. It is safe to say that 99 out of 100 times a low grade point average in mathematics courses taken implies a low accumulative grade point average for that student.

The main purpose was to give the student a rich mathematical experience in deductive and inductive reasoning. We did NOT plan to evade the problem

by diluting the course content. This was an endeavor to upgrade the material and the presentation. In order to aid the slower student, the video tapes could be used for review purposes by having re-showing of previous tapes. Student tutors could utilize the tapes for reviewing and unifying teacher and tutor ideas. It would unify course content in a basic course and hopefully create more faculty interest in an elementary course.

The video tape lectures (tele-lessons) are approximately of twenty minute duration. These were supplemented with a twenty-five minute period for questions and problem solving. The supplemental period was taught by a staff member.

Purpose of the Study

The principle concern was to develop contemporary mathematics by closed circuit television. In this project an attempt was made to develop new materials in respect to content and presentation. The content being different from the traditional necessitated the production of a loose-leaf syllabus for two years--1967-68 and 1968-69. In this time period through student and faculty critisicm, the materials have been revised and updated to overcome deficiencies in content emphasis and readability. In effect, the written materials have been class tested for two years.

The 1968-69 year was used to capitalize on the initial efforts made in the preceding year. That is, the information gained from class testing of the initial ideas have been utilized to make materials that are of quality to be tested. It should be pointed out that the enormity of the task of producing (not developing) the materials has prohibited a good research situation in 1968-69. And above all, such research was impossible at the termination of the CORD grant, Oct. 31, 1968. The student will have a complete set of materials believed to be of the desired quality at the

beginning of the 1969-70 school year. The same pertains to the development of the video-tapes--1967-68 was used for producing 60 tele-lessons and 1968-69 the remaining tele-lessons. During 1968-69 the completed video tapes were class-tested. Again through student and faculty evaluation we found that the tele-lessons needed revision to meet valid critisicms to make them of the desired quality before a valid research situation would exist. Another point which had to be kept in mind was that this was a joint venture between the mathematics and audio-visual aids departments in which capabilities had increased very substantially from our first experiences in this project. As one case in point, a graphic artist was employed in 1968-69 and his talents are now utilized to hopefully raise the quality of each lesson. Upon completion of the materials, written and tele-lessons, a comparative study was to be made. A standardized test (A.C.T.) was to be used to compare achievement between the following groups:

Group I: New materials plus teacher with video-lessons.

Group II: New materials plus teacher without video-lessons.

Group III: Traditional materials plus teacher.

The materials, written and tele-lessons, of desired quality were not completed for the 1968-69 school year. The entire manuscript was complete and ready for final adjustments necessitated by faculty and student critisicm in May, 1969. To this date, 83 video-lessons have been completed. In order to complete the series, approximately seven more tapes need to be completed. Then more time will be spent on revision to insure the necessary quality to make a comparative study.

Since the materials of justifiable quality have not been completed, we have results from a pilot study of individual units in the form of observations or opinions. I am of the opinion that a unit by unit comparison with existing materials would be invalid and impractical. For the new materials

stress the development and continuum of mathematics which can only be tested at the conclusion of the sequence. To do otherwise would be to defeat one of the objectives of the materials. Secondly, the sequence of concepts in the new materials differs from their sequence in existing materials. Thereby making unit by unit comparison impractical. This could be avoided by molding the sequence of concepts in the new materials with existing texts, but this would defeat our object of trying to develop the theory first and then to proceed to the application of the theory. That is, if the student understands why, then the student hopefully can comprehend the how. In fact, the standardized test will evaluate how these students compare on the how to do rather than the theory.

Course Outline

Included is the course outline of the new materials for your inspection. I would like to emphasize that the sequence and content differs from the traditional materials taught at Stout State University where the comparative study was to be made.

UNIT I. SYMBOLIC LOGIC AND THE NATURE OF PROOF

Logical Connectives
Rules of Inference
Conditional Proof
Indirect Proof
Deductive Systems

UNIT II. SET THEORY

Equality and subset concepts
Operations on sets
Algebra of sets
Algebra of switches

UNIT III. COUNTING NUMBERS

Cartesian products
Relations
Equivalence relations

Counting numbers as equivalence classes
Properties of counting numbers
Finite Induction
Natural exponents
Numeration systems

UNIT IV. INTEGERS

Integers as equivalence classes of CoXCo
Operations on integers
Basic properties of integers
Isomorphisms
Additive inverse properties
Order properties
Divisibility Properties
Division Algorithm
Fundamental Theorem of Arithmetic
Properties of absolute value

UNIT V. RATIONAL NUMBERS

Rationals as equivalence classes of ZXZ
Basic properties of rationals
Multiplicative inverse properties
Order properties
Integral exponents
Order properties for rational exponents
Decimal forms of rationals
Continued fraction approximations of irrationals
Rational exponents

UNIT VI. REAL NUMBER SYSTEM

Sequences
Operations on sequences
Basic properties of sequences
"Nice" and "Null" sequences
Reals as equivalence classes of the set of nice sequences
Basic properties of reals

UNIT VII. OPEN SENTENCES

Properties of reals in traditional notation
Solution sets dependent upon replacement sets
First degree equations
First degree inequalities
Quadratic equations
Quadratic formula
Quadratic inequalities

UNIT VIII. RELATIONS AND FUNCTIONS

Relations
Functions
Algebraic relations and functions
Distance
Formulation of relations and functions from distance concepts
Graphing

UNIT IX. ALGEBRA OF FUNCTIONS

Operations of functions
Composition of functions
Circular function
Sine and Cosine function
Reciprocal functions (secant and cosecant)
Quotient functions (tangent and cotangent)
Graphing circular functions
Basic Identities
Sum, difference, double angle, and half angle identities
Measure of angles
Interpolation
Circular function applications to right triangles
Inverse functions
Exponential and Logarithmic functions
Properties of Logarithmic functions

CHAPTER II

Plan and Organization of the Study

The pilot study consisted of a sample of 300 students divided arbitrarily into six classes. All classes used the new materials developed by the staff. Three of these classes, the control group, were taught by traditional classroom methods, and the three remaining classes were taught using the tele-lesson supplemented by the classroom teacher. Faculty and student evaluation of the individual tele-lessons and the developed written materials were periodically conducted. These evaluations were utilized as a comparative analysis of the effectiveness of the two procedures as well as to incorporate faculty and student opinions in improving the materials being developed.

The following facets were used to obtain information from the staff and students:

1. Feedback questionnaire regarding individual tele-lesson (included in the appendix).
2. Staff opinions.
3. Student opinions.
4. Evaluation questionnaire for a one semester course (included in the appendix.)

CHAPTER III

Results of the Study

As was previously stated, four means of evaluating the relative effectiveness of the methods of teaching, the tele-lessons, and the materials were used in the study: 1) feed back questionnaire of the tele-lessons, 2) staff opinions, 3) student opinions, and 4) evaluation questionnaire of a semester course.

Feed Back Questionnaire

The feed back questionnaire was used to evaluate the effectiveness of individual tele-lessons. The effectiveness was evaluated on the basis of teaching procedure, learning, and the technical presentation. The following questionnaires with accumulated total responses to each question represents the evaluations of three different tele-lessons.

Feed Back Questionnaire

Stout State University Math Project

Classroom Teacher Mr. Becker

Number of Students 22

Program Number Quadratic forms: 67

Date March 14, 1969

Teaching

1. Content: Right Amount 15 Too much 5 Too little 1
2. Development: Clear 7 Interesting 4 Weak 11
3. Visuals: Right amount 9 Too many 10 Too few 2

   (Which one)

   a. Shown long enough 13 Not long enough 6

   b. Effective 7 Didn't make the point 12
4. Speed of lecture: Right 9 Too fast 11 Too slow 2
5. Vocabulary: Right 20 Too difficult ____ Too easy 1
6. Level of the lesson for students: Too difficult 6

   Satisfactory 11 Too elementary 3
7. Length of program: Right 23 Too Long 8 Too short ____

Learning

8. Student Attention: Strong ____ Average 10 Poor 12
9. Student reaction to program: Favorable 1 Average 9

   Adverse 12
10. Student participation after program: Inadequate 10

    Adequate 10

Technical

11. Picture: Clear 19 Interference 5 Describe difficulty 0
12. Sound: Distinct 17 Not Clear 3 Describe difficulty 1

Feed Back Questionnaire

Stout State University Math Project

Classroom Teacher Mr. Becker

Number of Students 28

Program Number Intro. to Relations (70)

Date March 26, 1969

Teaching

1. Content: Right amount 21 Too much 3 To little 4
2. Development: Clear 10 Interesting 3 Weak 12
3. Visuals: Right amount 19 Too many 9 Too few ____

   (Which One)

   a. Shown long enough 24 Not long enoug 2

   b. Effective 15 Didn't make the point 10
4. Speed of lecture: Right 16 Too fast 4 Too slow 6
5. Vocabulary: Right 22 Too difficult 1 Too easy 5
6. Level of the lesson for students: Too difficult 3

   Satisfactory 17 Too elementary 6
7. Length of program: Right 18 Too long 10 Too short ____

Learning

8. Student Attention: Strong 1 Average 12 Poor 15
9. Student reaction to program: Favorable ____ Average 13 Adverse 15
10. Student Participation after Program: Inadequate 14 Adequate 12

Technical

11. Picture: Clear 24 Interference 3 Describe difficulty-1-Camera work poor
12. Sound: Distinct 23 Not Clear 3 Describe difficulty-1-slurring

Feed Back Questionnaire

Stout State University Math Project

Classroom Teacher Mr. Niedfeldt

Number of students 36

Program Number 26 a

Date March 31, 1969

Teaching

1. Content: Right amount 27 Too Much 2 To little 7
2. Development : Clear 16 Interesting 12 Weak 8
3. Visuals: Right amount 26 Too many 8 Too few 1

   (Which one)

   a. Shown long enough 27 Not long enough 2

   b. Effective 23 Didn't make the point 7
4. Speed of lecture: Right 26 Too fast 7 Too slow 2
5. Vocabulary : Right 31 Too difficult 2 Too easy 3
6. Level of the lesson for students: Too difficult 3

   Satisfactory 30 To elementary 3
7. Length of program : Right 30 Too long 1 Too short 4

Learning

8. Student Attention: Strong 5 Average 30 Poor 2
9. Student reaction to program: Favorable 8 Average 23

   Adverse 5
10. Student participation after program: Inadequate 9 Adequate 27

Technical

11. Picture: Clear 32 Interference 4 Describe difficulty 0
12. Sound: Distinct 34 Not clear 2 Describe Difficulty 0

Staff Opinions

Each of the participating instructors was asked to evaluate the materials. Three instructors expressed their views as follows:

Staff Member A

The presentation by tape is clearly and logically presented, utilizing many visual materials. The material is presented at a pace commensurate with the ability of the average student so that he readily grasps and understands the material.

Each tape is presented with the thought that the materials is relatively new. Sufficient examples are illustrated well and correlated with the written material so that a student may review in the text what the tape transmitted. Summaries are usually provided at the conclusion of each tape offering a review of basic concepts covered.

Some tapes are too long preventing the classroom instructor from discussing them thoroughly.

I believe the teacher can present this same material at a more rapid pace emphasizing identical concepts in conjunction with the use of a text such as "Introduction to Mathematics" by Lyle E. Mehlenbacher. This same feeling was expressed by many students.

Lastly, I believe Mr. Maki has done an outstanding job with this new material. If used in conjunction with the above text, the course would be challenging and interesting.

Staff Member B

I like sections on logic and sets. I would prefer less material on counting, integer and rational numbers. The bulk of the students don't benefit by such extensive treatment.

It goes plenty slow, no problem on speed. If anything, too slow. The tapes and text are very theoretically oriented. It must (and can) be related to more practical situations in class.

The tapes are improving -- more interesting, lively, etc.

The tapes, unfortunately, do not allow for questions as they occur. They are much more rigorous in proofs than I would be likely to be in class.

I am starting to get the impression that the students might be understanding what is going on more than some other types of students do. They are weak in manipulative skills, but are improving.

I like the course content for the most part, but I am not sure about the tapes yet.

Staff Member C

This course contains sound mathematics for pre-calculus students. It has an excellent logical presentation of the continuity and structure of mathematics. There is a need for more physical examples.

The tapes are well structured to present the content of the course in a logical manner. Attempts are made to make the content interesting.

The tapes are disliked by the majority of students now viewing them. I feel that the reasons for this are the following:

1. A number of the early tapes were comprised of prolonged periods where a seemingly unending series of statements rolled before them. This situation has been corrected by improved graphics and more life, but the habit of inattentive viewing established during this period has persisted.
2. College freshmen are sensitive about their maturity and are insulted by the level of vocabulary and humor of a number of the tapes. Mr. Maki is not a humorist and should not attempt to be one.
3. A number of the tapes are so constructed that the student need only watch and follow. All reasons, definitions, etc., are recalled and associated for him. He need not draw upon his acquired knowledge, he need not actively participate, and he does not.
4. The majority of the tapes are too long.

There are a number of very good tapes. Time and money are needed to improve the remaining tapes, especially in regard to reasons two and three above. I feel that the concept of television-aided-instruction has great potential. But, the tapes must aid and not dominate the course.

Student Opinions

Also, at times the students were asked to express their views regarding the study. These views were expressed at the end of the first semester of the 1968-69 academic year.

Students in the control group, new materials-instructor presented, expressed the following views.

Student A

From this course I learned that there is another way to learn math. I think this course has a great potential. It should be started in the lower grades of elementary school. A new way of doing something is always harder when you are older. I think we went over some to the materials a little fast but this can't be helped. The class was run very orderly. I liked the idea of not taking role for attendance. I feel thay by the time a person gets to college he shouldn't have to be told to go to class. I liked this course even though I am not particularly good at Math. It was a new experience for me.

Student B

I think that this has been one of the first algebra courses that I have had where I have learned most of the material. This is a good course I think that should be kept going. The course covered the whole book rather completely. The assignments were enough that you could tell if you understood the material or not. These tests are very well done according the the materials discussed in class and in the book.

This is the first course on this order that I have had. I enjoyed it quite well. I learned some of the things that makes math. What it is, not just formulas.

Student C

I think the class was really kind of interesting for a math course. The most significant thing I learned was how to use logic. I think there should have been more assignments to hand in because a lot of times when we didn't I wouldn't do them and that hurt in the end around test time. The tests were hard.

I can't really say anything rotten about the course because I really liked it. Class was O.K., the only complaint I have about that is the fact that I had it so early in the morning. Other than that it was interesting.

Student D

The greater need to study a subject which seems to have no merit, who's merit can be found only after hard study.

The ideas in the book were fine but in a school such as this a practical point should be pushed, not theory.

The assignments were all that should be required of college students who should do outside study.

Tests cover practical application which had not been covered well enough in class.

The class procedure was fine but more quizes would be of value.

We need more wasps to add life to the class.

Student E

I think there was way too much memorizing for a math course, if you didn't hit it right off the bat you had an almost impossible time with the rest. The course is not clear enough, there's too much reasoning and not enough fact.

Student F

I must admit that I didn't learn much of anything in the course during the semester. I don't feel that this course is practical because I can't see where I could use it. Maybe in the future I could apply this to something, but not now. It is much too hard to follow for someone who isn't a brain.

Students in the experimental group, new materials-tele-lesson presentation supplemented by an instructor, expressed the following views:

Student A

I think use of the tapes should be discontinued. For me the tapes tend to be boring so I do not pay attention to them like I should. It is usually only when our classroom instructor explains it again do I understand. The worst thing is that once you have the material the tape drags on. This is especially when we are fitting premises into the rules of inference.

Student B

I think the tapes are good - but not everyday. Two or three times a week would be fine. He's retarded, but I feel he gets his point across.

Student C

The tapes should be more explanatory, show more examples. Maybe a little less time in length of tape so classroom instructor can show problems, also questions can be asked.

Student D

I don't think the tapes should be used, you can't stop the tape and ask it questions, so if you don't get something in the first part of the tape the rest is meaningless.

I don't think the tapes have helped me too much, I'd rather be able to ask questions at all times.

Student E

Most tapes are helpful, and the speaker has definitely got the attention of the class, but sometimes the speaker goes a little fast which makes it hard to understand his ideas.

Student F

I feel the tapes would be a help to us if there were enough time left over for the instructor to explain any problems the students may have. So far, the tapes should be, I feel, still utilized for future use in Math.

Student G

The tapes are very helpful. Anything we don't understand on the tapes, we can ask the class instructor. So, really we go over the material twice. But the tapes could be a little more interesting.

Student H

In my opinion, I would say that the tapes should remain approximately the same length. The tapes have helped me a great deal. I understand this math logic much better than I have any other type of math.

Student I

I feel the music added to tapes to keep your attention. A little more humor would active a person mind as humor is a fantastic element for attention.

The tone of Mr. Maki's voice is far too harsh at times. It not only put you to sleep but it also distorts your train of thought when awake. The speed of the tape is good but repetition is too often.

Student J

The aids were too small and were far too elementary for college students. Many had nothing to do with the subjects discussed. The tapes many times were boring. The tapes are too slow in may subjects. They repeat too much.

Student K

I feel that your idea of using both the teacher and the tapes is VERY GOOD. It makes the material far easier to understand if there are two ways to present the material. I think that the humor is a little overdone on some of the tapes but the idea is a good one. I feel that at times you are going to slow. I feel I am an average student. (Grade point is 2.43). It is most important that you fix up that book we are now using. There are far to many mistakes and the reproduction is sometimes poor.

It might help if the length of the tapes is made shorter. It is too much to expect a student to hold his head at a steep angle for 30 minutes. I feel that about 20 or a little less would be better.

Evaluation Questionnaire

The evaluation questionnaire (copy in appendix) was completed by students in both groups. The first 16 questions were answered by all students in the study and questions 17-21 were answered only by the students using the tele-lessons presentation. The following raw data and percent breakdown of the individual items is the compilation of 108 responses evaluated.

Raw Data Received from the Evaluation Questionnaire

	A	B	C	D	E
1.	92	21	55		
2.	102	31	35		
3.	48	57	63		
4.	80	44	43		
5.	62	42	64		
6.	45	79	44		
7.	77	23	66		
8.	67	39	62		
9.	61	31	75		
10.	82	38	20	9	10
11.	119	49			
12.	31	137			
13.	43	125			
14.	76	91			
15.	100	5	63		
16.	12	78	77		
17.	24	71	13		
18.	26	82			
19.	18	55	35		
20.	62	17	29		
21.	62	44			

)Total responses: 108

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Data in Percent Form from the Evaluating Questionnaire

1. 55% devote more time to studying
2. 61% find course more difficult than previous courses
3. 66% study with more v same interest as previous
4. 48% thought past math courses proved helpful
5. 37% grades improved over last course

   25% grades declined over last course
6. 53% like the material content more v same as last course
7. 46% think tests reflect content of course well
8. 40% think grade received reflected well amount learned
9. 36% feel they learned much regardless of grades
10.
11. 71% thought course is presented in coherent manner
12. 18% decided to take more math on the basis of this experience
13. 26% enjoy this more than any other math course
14. 46% see relevancy of this course to practical application
15. 60% would study more if they could begin the course again
16. 46% study less than 5 hours per week
17. 66% like studying by T.V. tapes less than by traditional means
18. 76% find the topics difficult to follow
19. 68% find that tapes hold their interest always v occasionally
20. 57% think the speed of presentation on T.V. tapes is too fast

    16% think presentation is too slow

    27% think speed is about right
21. 58% claim that visual aids are almost always clearly visible

Then a further analysis was made between the responses to the evaluation questionnaire by two special groups. Group I reviewed 67 original tele-lessons and Group II reviewed 25 tele-lessons which were revisions of originals. Their raw data and percentage breakdown of the 21 items are as follows:

Raw Data to Questionnaire Involving Two Groups

	Group I Sample 48				Group II Sample 60			
	A	B	C	D	A	B	C	D
1.	15	8	23		38	5	17	
2.	34	5	9		32	13	15	
3.	8	24	16		23	12	25	
4.	30	7	10	1	22	20	18	
5.	11	16	21		29	13	18	
6.	7	23	18		24	23	13	
7.	14	12	21		43	2	15	
8.	13	15	20		30	10	20	
9.	11	11	25		30	9	21	
10.	22	10	8	4	36	16	4	
11.	30	18	0		39	21		
12.	7	41	0		14	46		
13.	8	40			22	38		
14.	23	25			22	38		
15.	27	1	20		37	2	21	
16.	1	16	31		6	34	20	
17.	2	39	7		22	22	6	
18.	6	42			20	40		
19.	0	21	27		18	34	8	
20.	27	9	12		35	8	17	
21.	31	17			31	27		

18 and 2 same

Percent Evaluation of Responses to some of the Questions

	Group I	Group II
2.	71% find this course more difficult than last	53% find this course more difficult than last
3.	50% study this with more v same amount of interest as last	80% study this with more v same amount of interest as last
5.	23% grades improved 33% grades declined 44% grades remained same	48% grades improved 22% grades declined 30% grades remained same
6.	15% like content more 48% like content less 37% like content same as prev.	40% like content more 38% like content less 22% like content same as prev.
7.	30% think tests reflect content well 25% think tests reflect content poorly	72% think tests reflect content well 3% think tests reflect content poorly
9.	23% felt they had learned much regardless of grades	50% felt they had learned much regardless of grades
12.	15% desire to take more math courses on the basis of this experience	23% desire to take more math courses on the basis of this experience
13.	17% enjoy this more than any other	37% enjoy this more than any other
14.	48% see relevancy of this to practical application	36% see relevancy of this to practical application
17.	81% like studying by T.V. less 4% like T.V. method more	37% like studying by T.V. less 37% like T.V. method more

Group I	Group II
18. 87% find topics difficult to follow and understand	67% find topics difficult to follow and understand
19. 0% say tapes hold interest always 44% say tapes hold interest occasionally 56% say tapes hold interest rarely	30% say tapes hold interest always 57% say tapes hold interest occasionally 13% say tapes hold interest rarely
20. 25% speed of presentation about right 56% speed of presentation too fast	28% speed of presentation about right 58% speed of presentation too fast
21. 65% visual aids are almost always clearly visible 35% visual aids are not almost always clear	52% visual aids are almost always clearly visible 48% visual aids are not almost always clear

CHAPTER IV

Summary and Conclusions

The sample being researched in this pilot study was a homogeneous group, that is, these students rate 50% or below on the mathematics portion of the A.C.T. on entering college. Therefore, it is heartening to have such a good reception of theory-oriented materials. Heretofore, it had been accepted that students of lower capabilities in mathematics could only succeed in cookbook type of mathematics.

I wish to re-emphasize that this pilot study was made to evaluate materials and their presentation by tele-lessons in their developmental stage. In fact, the seed monies provided by C.O.R.D. were used to buy $2800 worth of video-tapes and $1536 was used to reproduce the first semesters written materials for 1968-69 pilot study.

The remaining funds for the production of materials were provided by Stout State University. This includes released faculty personnel in the mathematics and audio-visual aids departments. The schools contribution propagated the project, whereas, C.O.R.D. funds allowed initiation of the project. The seed monies alloted to the project did not allow for an effective research on a project of this scale.

During the 1969-70 academic year a study of the same format as our pilot study could be carried out on the materials of acceptable quality. But additional funds are necessary to study a large number of the individual tele-lessons to determine whether they meet their objectives and create a good learning situation. Funds are needed to coordinate all teachers using tele-lessons to keep unity and to assure that the students are encouraged to view the tele-lessons by having teachers amplify on the

tele-lesson and to quiz the students on their content. For such a controlled curriculum development to perfect the existing state of the mathematics project would necessitate funds for at least 15 months duration. In this time, individual tele-lessons would be evaluated and revised to meet specified objectives of each lesson. To meet this end, a certain amount of money should be pre-determined and then utilized. The completed portion of the project has not been handled in this manner. At the initial stage the project was funded for one summer and some released time for 1967-68. Then at a very late date in 1967-68 year C.O.R.D. funds became available to reproduce the written materials and we were to continue on released time during 1968-69 if class loads warranted it. Summer of 1968 and 1969 have been funded by Curriculum Development Grants by the State of Wisconsin. So it has been difficult to meet pre-determined objectives on a project which has consisted of several extensions rather than an integrated two year research grant which this initial program probable should have been.

As to the evaluation of the content of the course in the future, I suggest the following:

Three tracks of students would exist if a comparative study is made during 1969-70 academic year.

Group I: Teacher and new written materials

Group II: Teacher and tele-lesson and new written materials

Group III: Teacher and traditional materials

Then a sample of each group would continue into calculus. The success in calculus of each sample of the three groups would be determined and compared to demonstrate which approach affords the best pre-calculus preparation.

Summary of Indications

1. In response to questions #2 and #18 we find a majority in both cases think the topics are difficult. Hence, this indicates that tapes alone do not account for difficulties.
2. In response to question #14, a near majority can appreciate the relevancy to application.
3. Two thirds of the respondents indicated that they study with more or the same interest as previously.
4. The majority of the students like this materials more or the same as their last course.
5. 37% of the grades improved over their last grade.
6. Two thirds ofthe students like studying by T.V. less than by traditional means.
7. There is a radical difference between student and faculty evaluation of the speed of the tele-lessons.

Summary of Analysis Between Special Groups I and II

1. Much lower percent of students in Groups II find this course more difficult than their last.
2. Thirty percent increase in student interest.
3. Only thirty percent in Group I believed that the tests reflect content well. Hence, it is possible that tests do not complement or reflect on tele-lessons but rather on problems or exercises. This seems to be substantiated by the response to question #19. That is, low percent believe the tests reflect content well and a high percent are rarely interested by the tele-lessons.

4. Nearly three-fourths of the students in Group II believe that the tests reflect the content well, hence, a very small percent are rarely interested in the tele-lesson.
5. Group II shows that dislike and like for tele-lessons is equal whereas in Group I nearly all disliked tele-lessons. This seems to indicate that there is an acceptance to this method of presentation and it can create interest.

Then on the basis of faculty and student evaluations I make these observation.

1. Written materials need to be condensed somewhat.
2. Some duplication should be eliminated but not all for the repetitive nature of the materials is necessary for some of the academically weaker students to meet success.
3. The exercises and the test must be theory oriented so that they will dovetail with the theory oriented tele-lessons.
4. Stronger coordination of the participating teachers is necessary. That is, a research rather than developmental attitude is necessary.
5. Evaluation of the revised tele-lesson indicates that it may take time to create an acceptance to a new method of presentation by students and faculty.
6. It seems to be of value to many students to know "why" certain techniques hold rather than "how" these techniques hold.
7. From a comparison of unit examinations given to the experimental group, (tele-lesson and classroom teacher) and the control group (classroom teacher), it was observed that there was no significant difference on achievement between the two methods.

A comparative analysis between the first semester grades in 1966

(when no new materials were used) and 1968 revealed the following:

Fall 1966

Sample: 295

Grade Distribution

A - 12/295 or 4%

B - 26/295 or 9%

C - 106/295 or 36%

D - 88/295 or 30%

F - 63/295 or 21%

Fall 1968 (New materials)

Sample: 261

Grade Distribution:

A - 18/261 or 7%

B - 43/261 or 16%

C - 92/261 or 35%

D - 82/261 or 31%

F - 26/261 or 10%

In the fall of 1968 the percentage of A & B grades increased 10% in comparison with 1966 when the new materials were not in use. Also the percentage of F grades decreased 11% from 1966 to 1968. So it seems more students are able to master this subject matter in comparison with the traditional. And the lower percentage in the combined group of D & F would indicate that the influence of the math grade on dropouts has lessened.

APPENDIX

Evaluation Questionnaire for Introductory College Mathematics Course

(Maki-Becker)

I. List in chronological order the names of mathematics courses taken while in high school and elsewhere prior to this course. Indicate the final grade average received in each course.

	Name of Course	Grade
1.		
2.		
3.		
4.		

II. Answer the following questions by blackening the appropriate blank on the IBM form. For example in question 1, if you desire to answer "Less", blacken response "B" on the IBM form adjacent to question 1.

1. I devote (more less same) amount of time to studying this course compared to my last mathematics course.
2. I find this course (more less same) in terms of difficulty compared to my last course.
3. I study this course with (more less same) amount of zeal or interest compared to my last course.
4. My past courses in mathematics proved (helpful non-helpful non-influential) in the course.
5. My grades (improved declined remained the same) compared to my last course.
6. I like the material content of this course (more less same) compared to my last course.
7. The tests reflect the content of the course (well poorly so-so).

8. The grade I received in the course reflected (well poorly so-so) the amount of material I learned.
9. Regardless of grades on tests I feel I learned (much little some) in this course.
10. My favorite topic was (logic, sets, counting numbers, integers, rational numbers).
11. Is the course presented in a coherent logical manner? (yes no)
12. By taking the course do I desire to take more courses in mathematics beyond my program requirements? (yes no)
13. I enjoy this course morethan any other mathematics course? (yes no)
14. I now see the relevancy of this course in terms of practical application? (yes no)
15. If I could begin the course again, I would study (more less same).
16. I study (more than 10 hours per week, five to nine hours per week, less than five hours per week).

These questions are to be answered by those students who used the T.V. tapes.

17. I like studying by use of television tapes (more less same) than studying by traditional classroom methods.
18. I find the topics (easy difficult) to follow and understand.
19. The tapes hold my interest (always occasionally rarely).
20. The speed of presentation of the T.V. tapes is (too fast too slow about right) for me.
21. The visual aids employed on the tapes are almost always clearly visible? (yes no)